12/PRTS 10/538149
JC17 Rec'd PCT/PTO 08 JUN 2005

Description

ELECTRONIC APPARATUS AND METHOD OF IMAGING BY USING THE ELECTRONIC APPARATUS

<Technical Field>

The present invention relates to an electronic apparatus capable of realizing a flash function and a method of imaging by using the electronic apparatus.

<Background Art>

In recent years, the high performance and the high function of mobile communication terminals such as portable telephones or PHS have progressed and various kinds of communication terminals have been sold. Today, a portable telephone having a camera among them has been most overwhelmingly supported by users. The portable telephone having the camera is desired to improve the quality of an image so as to be equal to the quality of the image of a digital camera in future.

In order to improve the quality of the image, a performance such as the sensitivity or the resolution of a solid image pick-up element (a CCD sensor, a CMOS sensor, etc.) needs to be improved. However, to realize the improvement of the quality of the image to be imaged under an environment of a low intensity of illumination, a flash function may be considered. Accordingly, a portable telephone (for instance, see Patent Document 1) in which a flash device is incorporated or a flash device as a peripheral device of a portable

telephone has been devised. Particularly recently, a portable telephone in which a high luminance LED is incorporated to provide a flash function has been also considered.

Further, usual portable telephones or fixed telephones includes a lamp which is blinked for calling a user upon receiving a call or a flash device formed as a flash lamp such as discharge tubes to emit a light. Further, there are portable telephones in which the lamp or the flash device are provided as outer parts, not incorporated.

As such usual examples in which visible lights are blinked upon receiving a call, a certain portable telephone separate from a fixed telephone includes a flash lamp to emit the light of the flash lamp synchronously with a calling signal when a call is received (for instance, Patent Document 2). Further, a portable telephone includes a liquid crystal display device with a back light to blink and emit the lights of the back light of the liquid crystal display device (for instance, see Patent Document 3). Further, a portable telephone includes a light emitting element separate from the portable telephone to allow the light emitting element to emit lights when the portable telephone receives a call (for instance, see Patent Document 4).

Further, as the flash device mounted on a camera to be used or incorporated in the camera to be used, a flash device includes a second light emitting part for emitting two different monochromatic lights of red and blue separately from a first light emitting part for emitting the light of a flash, so that the lights of red or blue or both red and blue are continuously emitted for a prescribed time when the light of the flash of the first light emitting part is emitted to correct the color temperature of the flash to set color temperature (for

instance, see Patent Document 5).

(Patent Document 1) JP-A-2001-320622

(Patent Document 2) JP-UM-A-7-14739

(Patent Document 3) JP-A-3-280778

(Patent Document 4) JP-UM-B-3082867

(Patent Document 5) JP-A-10-206942

However, the above-described usual portable telephones having cameras newly require flash devices or LEDs for realizing flash functions to improve the quality of an image under the environment of a low intensity of illumination. Accordingly below-described problems are risen. That is, when parts such as the flash device or the LED are incorporated in the portable telephone, the portable telephone cannot be miniaturized due to the increase of a mounting area or thickness. Further, since large noise is generated when the light of the flash is emitted, this noise inconveniently gives an adverse effect to other parts. Still further, since the new parts, that is, the parts such as the flash device or the LED need to be newly mounted, a cost is more increased.

The present invention is proposed by considering the above-described usual problems and it is an object to provide an electronic apparatus capable of realizing a flash function without mounting new parts and a method of imaging by using the electronic apparatus.

<Disclosure of the Invention>

To achieve the above-described object, an electronic apparatus according to the present invention includes a display unit and an image pick-up unit. A display surface of the display unit and a image pick-up direction of the

image pick-up unit are set to the same direction. The electronic apparatus includes a display control unit for controlling to switch the display luminance of the display unit by at least two levels and controlling the display unit to display a prescribed image with the highest luminance level when the image pick-up unit picks up an image. Accordingly, a flash function can be realized without mounting new parts. As a result, the increase of a mounting area or thickness due to the addition of new parts, the generation of noise upon emitting the light of a flash and the increase of a cost can be eliminated.

Further, in the electronic apparatus according to the present invention, the display control unit changes the display luminance of the display unit before and after a moment when the image pick-up unit picks up the image, switches the display luminance of the display unit to the highest luminance level before the moment when the image pick-up unit picks up the image and switches the display luminance of the display unit to a luminance level lower than the highest luminance level after the moment when the image pick-up unit picks up the image. In such a way, since the luminance is enhanced only in a moment when the image is imaged, a consumed electric power can be reduced.

In the electronic apparatus according to the present invention, the prescribed image is an image in which all pixels forming the display unit emit white lights. All the pixels are allowed to emit the white lights so that brightness required upon emitting the light of the flash can be most efficiently obtained.

Further, in the electronic apparatus according to the present invention, the prescribed image is an image previously selected before the image pick-up unit picks up the image.

Further, in the electronic apparatus according to the present invention, the display unit includes a first display unit provided in a front surface side of the electronic apparatus and a second display unit provided in a back surface side of the electronic apparatus. The image pick-up unit includes a first image pick-up unit provided in the front surface side of the electronic apparatus and a second image pick-up unit provided in the back surface side of the electronic apparatus. When the image is imaged by the second image pick-up unit, the display control unit desirably controls the second display unit to display the prescribed image with the highest luminance level and controls the first display unit to display the image from the second image pick-up unit in an arbitrary luminance level. When the image is imaged by the first image pick-up unit, the display control unit controls the first display unit to display the prescribed image in the highest luminance level and controls the second display unit to display an arbitrary image in an arbitrary luminance level.

Further, a method of imaging by using an electronic apparatus which includes a display unit and an image pick-up unit, and the display surface of the display unit and the image pick-up direction of the image pick-up unit being set to the same direction. The display luminance of the display unit is controlled to be switched to at least two levels and the display unit displays a prescribed image in the highest luminance level when the image pick-up unit picks up an image.

Further, in the method of imaging according to the present invention, the display luminance of the display unit is switched to the highest luminance level before a moment when the image pick-up unit picks up the image. The display luminance of the display unit is switched to a luminance level lower than

the highest luminance level after the moment when the image pick-up unit picks up the image.

Further, an electronic apparatus according to the present invention includes a light emitting unit that emits light by supplying electric current thereto; a lighting control unit for controlling a lighting of the light emitting unit; and a lighting instructing unit for instructing the lighting control unit to control the lighting of the light emitting unit. The lighting control unit controls the lighting of the light emitting unit with a first luminance for a first use of lighting. The lighting control unit controls the lighting of the light emitting unit with a second luminance for a second use of lighting when an instruction for lighting is supplied from the lighting instructing unit.

According to this structure, one light emitting unit can be lighted in a plurality of difference luminance and utilized for various kinds of uses of lighting so that suitable light emitting states can be obtained respectively for the uses. For instance, in the electronic apparatus having the image pick-up unit, assuming that the first use of lighting is to inform a user of receiving a call of a telephone or the like and the second luminance in the second use of lighting is higher than the first luminance in the first use of lighting, the light emitting unit such as the LED can be used as a flash (for imaging and lighting) when the image is imaged by the image pick-up unit. In this case, an exclusive light emitting unit for improving the quality of an image by using a flash under the environment of a low intensity of illumination does not need to be provided. Accordingly, the increase of a mounting area or thickness due to the addition of new members, the increase of a cost or the like can be suppressed, the device can be miniaturized, the cost can be reduced and noise can be reduced.

Further, as one aspect of the present invention, the lighting control unit controls the lighting of the light emitting unit to inform a user of receiving a call for the first use of lighting when a call is received by a communication unit.

According to this structure, the light emitting unit is used for informing the user of receiving a call, so that the user can visually know a received call of the telephone or the like.

Further, as one aspect of the present invention, the lighting control unit controls the lighting of the light emitting unit for informing a user of a time of alarm for the first use of lighting when it is a prescribed alarm setting time.

According to this structure, the light emitting unit is used for informing the user of the time of alarm so that the time of alarm can be visually informed.

Further, as one aspect of the present invention, the lighting control unit controls the light emitting unit to emit light for an imaging light operation of an image pick-up unit as the second use of lighting.

According to this structure, the light emitting unit is used for the imaging light operation as the second use of lighting, and accordingly, one light emitting unit can be used for informing the user of receiving a call or the time of alarm and can be used for the imaging light operation to emit the light of a flash.

Still further, as one aspect of the present invention, when the imaging light operation of the image pick-up unit are carried out for the second use of lighting, the lighting control unit controls the light emitting unit to emit light with a second luminance before the imaging operation by the image pick-up unit and controls the light emitting unit to emit light with a third luminance brighter than the second luminance during the imaging operation by the image pick-up unit.

According to this structure, when the light emitting unit is used for the

imaging light operation, for instance, a previous light emission before the imaging operation and the light emission of a flash during the imaging operation can be realized by one light emitting unit. Thus, an imaged image with high quality of an image can be obtained.

<Brief Description of the Drawings>

Fig. 1 is a block diagram showing the structure of a portable telephone of one embodiment according to the present invention;

Fig. 2 is an external appearance view showing the portable telephone of one embodiment according to the present invention;

Fig. 3 is an explanatory view showing the respective contents of displays and the respective display luminance of a display part and a backside display part during a preview operation and during an imaging operation when an image is picked up by using a backside image pick-up part;

Fig. 4 is an explanatory view showing the respective contents of displays and the respective display luminance of the display part and the backside display part during a preview operation and during an imaging operation when an image is picked up by using an image pick-up part;

Fig. 5 is a flowchart showing an image pick-up procedure when the image is picked up by using the backside image pick-up part;

Fig. 6 is a flowchart showing the image pick-up procedure when the image is picked up by using the image pick-up part;

Fig. 7 is a block diagram showing the structure of a portable telephone of one embodiment according to the present invention;

Fig. 8 is a perspective view showing the structure of an external

appearance of the portable telephone of one embodiment according to the present invention, Fig. 8(a) showing a front surface side and Fig.8(b) showing a back surface side;

Fig. 9 is a flowchart showing a schematic procedure of an imaging operation when a second image pick-up part in the portable telephone of the one embodiment according to the present invention is used;

Fig. 10 is an explanatory view showing the luminance states of an LED part during a preview operation and during an image pick-up operation of the portable telephone of the one embodiment according to the present invention;

Fig. 11 is an explanatory view of an operation showing the luminance change of the LED part of the portable telephone of the one embodiment according to the present invention;

Fig. 12 is a perspective view showing the structure of an external appearance of a first applied example of the portable telephone of the one embodiment according to the present invention;

Fig. 13 is a perspective view showing the structure of an external appearance of a second applied example of the portable telephone of the one embodiment according to the present invention; and

Fig. 14 is a perspective view showing the structure of an external appearance of a third applied example of the portable telephone of the one embodiment according to the present invention.

In the drawings, reference numeral 101 designates a portable telephone. 102 designates a radio transmitting and receiving part. 103 designates a voice transmitting and receiving part. 104 designates a handset. 105 designates an operating part. 106 designates a memory. 107

designates a control part. 108 designates a display part. 109 designates a backside display part. 110 designates an image pick-up part. 111 designates a backside image pick-up part. 112 designates an antenna. 201 designates an antenna. 202 designates a radio transmitting and receiving part. 203 designates a handset. 204 designates a voice transmitting and receiving part. 205 designates an operating part. 206 designates a storing part. 207 designates an LED part. 208 designates a first display part. 209 designates a second display part. 210 designates a first image pick-up part. 211 designates a second image pick-up part. 212 designates a light source part for a first display part. 213 designates a light source part for a second display part. 214 designates a control part. 215 designates a reflecting material.

<Best Mode for Carrying Out the Invention>

(First Embodiment)

Embodiments of an electronic apparatus and a method of imaging using the electronic apparatus according to the present invention will be described by referring to the drawings. In this embodiment, as the electronic apparatus according to the present invention, a portable telephone having a camera (refer the portable telephone having the camera to simply as a "portable telephone" hereinafter) will be described as an example.

In this case, electronic apparatuss having display parts are not limited to the portable telephones and may be applied to PDAs, note type PCs and digital cameras.

Fig. 1 is a block diagram showing the structure of a portable telephone of one embodiment according to the present invention. The portable telephone

101 of this embodiment includes an antenna 112, a non-voice transmitting and receiving part 102, a voice transmitting and receiving part 3, a handset 104, an operating part 105, a memory 106, a control part 107 corresponding to a display control unit in claims, a display part 108 corresponding to a display unit and a first display unit, a backside display part 109 corresponding to the display unit and a second display unit, an image pick-up part 110 corresponding to an image pick-up unit and a first image pick-up unit, and a backside image pick-up part 111 corresponding to the image pick-up unit and a second image pick-up unit.

When a user operates the operating part 105 to turn on the power of the portable telephone 101, the control part 107 detects that the power is turned on to make each part operable. Then, when the operating part 105 is operated to input the telephone number of a mate or the operating part 105 is operated to call the telephone number of the mate stored in the memory 106 and press a call transmitting key, a radio transmission for calling is performed to a base station from the antenna 112 through the non-voice transmitting and receiving part 102. When the mate responds to a call, the control part 107 receives a response signal sent from the base station at the non-voice transmitting and receiving part 102 through the antenna 112 to make the voice transmitting and receiving part 103 operable. Thus, the user of the portable telephone 101 can speak to the mate through the handset 104.

Further, when the power of the portable telephone 101 is turned on, the display part 108 and the backside display part 109 display that the power of the portable telephone is turned on. When the telephone number is inputted or called, the display part 108 and the backside display part 109 display the

telephone number. When the mate responds to a call, the display part 108 and the display part 109 display that the mate responds to the call. The control part 107 controls the display part 108 and the backside display part 109 when an object to be imaged is imaged. When the user operates the operating part 105 to pick-up an image, the control part 107 transfers and stores the data of the picked up image to the memory 106.

Fig. 2 is an external appearance view showing the portable telephone 101 of this embodiment. As shown in Fig. 2, the portable telephone 101 is a foldable or collapsible type in which an upper casing member 1a and a lower casing member 1b freely open and close through a hinge part 1c. As shown in Fig. 2(A), the display part 108 and the image pick-up part 110 are disposed on the same plane, that is, an inner surface (front surface) of the upper casing member 1a. The operating part 105 including various kinds of keys such as a power key 115 or a shutter key 116 is provided on an outer surface (back surface) of the upper casing member 1a. As shown in Fig. 2(B), the backside display part 109 and the backside image pick-up part 110 are disposed on the same plane, that is, the back surface of the upper casing member 1a. As described above, the two image pick-up parts are mounted on the portable telephone 101 of this embodiment.

When the image of an object to be imaged is picked up, the display contents and the luminance of the display part 108 and the backside display part 109 are different based on the image pick-up part to be used. Fig. 3 is an explanatory view showing the respective display contents and the respective display luminance of the display part 108 and the backside display part 109 during a preview operation and during an imaging operation when the image is

picked up by using the backside image pick-up part 111. Fig. 4 is an explanatory view showing respectively the display contents and the display luminance of the display part 108 and the backside display part 109 during the preview operation and during the imaging operation when the image is picked up by using the image pick-up part 110.

As shown in Fig. 3, during the preview operation when the image is picked up by using the backside image pick-up part 111, an image from the backside image pick-up part 111 is displayed on the display part 108 with an arbitrary luminance and an image exclusive for a flash is displayed on the backside display part 109 with a luminance 1. Further, when the image is picked up by using the backside image pick-up part 111, an image from the backside image pick-up part 111 is displayed on the display part 108 with an arbitrary luminance and an image exclusive for a flash is displayed on the backside display part 109 with a luminance 2. In the luminance 1 and the luminance 2, the luminance 2 is higher in a luminance level than the luminance 1. The display of the image exclusive for a flash under the luminance 2 serves as a flash function. Further, the image exclusive for the flash displayed on the backside display part 109 during the preview operation does not need to be the same as the image exclusive for the flash displayed on the backside display part 109 during the imaging operation, and may be different from the image exclusive for the flash displayed on the backside display part 109.

On the other hand, as shown in Fig. 4, during the preview operation when the image is picked up by using the image pick-up part 110, an image from the image pick-up part 110 is displayed on the display part 108 with a luminance 3 and an image exclusive for a flash is displayed on the backside

display part 109 with a luminance 4. Further, when the image is picked up by using the image pick-up part 110, an arbitrary image is displayed on the display part 108 with an arbitrary luminance and an arbitrary image is displayed on the backside display part 109 with an arbitrary luminance. In the luminance 3 and the luminance 4, the luminance 4 is higher in a luminance level than the luminance 3. The display of the image exclusive for the flash in the luminance 4 serves as the flash function.

The image exclusive for the flash may be displayed by reading image data previously stored in the memory 106. A display in which all pixels are simply white may be employed. All the pixels emit white lights so that necessary brightness upon emitting the light of the flash can be most efficiently obtained. In this case, when the pixels emit red, blue and green lights, a special imaging operation different from an ordinary imaging operation can be performed. For instance, when all the pixels emit the red lights, an interesting effect can be given to a captured image.

As the image exclusive for the flash, one kind of an image exclusive for the flash is prepared, however, a plurality of kinds of images exclusive for the flashes may be prepared. For instance, the plurality of kinds of images exclusive for the flashes may be previously stored in the memory and a desired image exclusive for the flash may be selected in accordance with an operation of a prescribed key by the operating part 105 before the imaging operation is started.

Next, an operation (a flash imaging method) of the portable telephone 101 when the image is picked up by using the portable telephone 101 of this embodiment will be described by referring to Figs. 5 and 6.

Fig. 5 is a flowchart showing an image pick-up procedure when the image is picked up by using the backside image pick-up part 111. A program for executing the image pick-up procedure shown in Fig. 5 is stored in a memory (not shown in the drawing) in the control part 107. For instance, when the user operates a prescribed key to enter a preparing step for the imaging operation, a CPU (not shown in the drawing) in the control part 107 executes the program concerned.

When the image is picked up (a backside image pick-up) by using the backside image pick-up part 111, the display part 108 is used in place of a finder and the backside display part 109 is used for a flash light source. Firstly, during the preview operation that is a preparing step for the imaging operation, a screen exclusive for a flash is displayed on the backside display part 109 with the luminance level of the luminance 1 to perform the preview operation for continuously displaying the image from the backside image pick-up part 111 on the display part 108 with an arbitrary luminance (step S11). In the preview operation in the step S11, a black screen having a luminance value 0 may be displayed on the backside display part 109 as the brightness of the luminance 1. However, under the environment of a low intensity of illumination, when a preview screen is dark so that the object to be imaged is hardly seen, the backside display part 109 is preferably lighted with the luminance 1 having brightness to some degree to use the backside display part 109 instead of a light for lighting the object to be imaged.

Then, during the preview operation, it is determined that whether or not the shutter key 116 is pressed (step S12). When the shutter key 116 is not pressed, the procedure returns to the step S11 to continuously carry out the

preview operation. When the shutter key 116 is pressed (namely, during an image pick-up operation), the display luminance of the backside display part 109 is set to the luminance 2 brighter than the luminance 1 to carry out a flash operation. The backside image pick-up part 111 picks up the image at the timing of the flash operation (step S13). The luminance 2 is previously set to a luminance corresponding to the flash light. Then, the image data of the image picked up by the backside image pick-up part 111 is captured and stored in the memory 106 (step S14). The display luminance of the display part 108 when the image is picked up in the step S13 may be an arbitrary luminance to meet the display of a preview.

After the image data is captured, the display luminance of the backside display part 109 is returned from the luminance 2 to the luminance 1 to display the image for the flash (step S15). After that, the prescribed key is operated by the operating part 105 to discriminate whether or not the imaging operation is finished (step S16). When the imaging operation is not finished, the procedure returns to the process of the step S11. When the imaging operation is finished, this procedure is terminated.

Fig. 6 is a flowchart showing an image pick-up procedure when the image is picked up by using the image pick-up part 110. A program for executing the image pick-up procedure shown in Fig. 6 is stored in the memory (not shown in the drawing) in the control part 107. For instance, when the user operates the prescribed key to enter the preparing step for the imaging operation, the CPU (not shown in the drawing) in the control part 107 executes the program concerned.

When the image is picked up (a front surface image pick-up) by using

the image pick-up part 110, the display part 108 is used instead of a finder and also used for a flash light source. In this case, since the backside display part 109 is not used for the flash light source, the backside display part 109 displays an arbitrary image with an arbitrary luminance both during the preview operation and during the imaging operation. Firstly, during the preview operation that is the preparing step for the imaging operation, the preview operation is carried out for continuously displaying the image from the image pick-up part 110 on the display part 108 with the luminance level of the luminance 3 (step S21).

Then, during the preview operation, it is determined that whether or not the shutter key 116 is pressed (step S22). When the shutter key 116 is not pressed, the procedure returns to the step S21 to continuously carry out the preview operation. When the shutter key 116 is pressed (namely, during an image pick-up operation), the display luminance of the display part 108 is set to the luminance 4 brighter than the luminance 3 and a display screen is simultaneously switched to an image exclusive for a flash to carry out a flash operation. The image pick-up part 110 picks up the image at the timing of the flash operation (step S23). The luminance 4 is previously set to a luminance corresponding to the flash light. Then, the image data of the image picked up by the image pick-up part 110 is captured and stored in the memory 106 (step S24).

After the image data is captured, the display luminance of the display part 108 is returned from the luminance 4 to the luminance 3 and the display screen is switched to the image from the image pick-up part 110 (step S25). After that, it is determined that whether or not the imaging operation is finished by operating the prescribed key of the operating part 105 (step S26). When

the imaging operation is not finished, the procedure returns to the process of the step S21. When the imaging operation is finished, this procedure is terminated.

As described above, in the portable telephone 101 of this embodiment, when the image is picked up, the light emitted from the display part 108 or the backside display part 109 is used as the flash light source. Thus, a flash function can be realized without newly mounting parts such as a flash device or an LED. As a result, problems such as the increase of a mounting area or thickness due to the addition of the new parts, the generation of noise upon emitting the light of a flash and the increase of a cost can be eliminated. As the display luminance of the display part 108 or the backside display part 109 used as the flash light source, the luminance is raised only for a moment when the image is imaged (during the imaging operation), so that a consumed electric power can be reduced.

The two image pick-up parts and the two display parts are respectively mounted on the portable telephone 101 of this embodiment. However, three or more of the image pick up parts and the display parts may be mounted on the portable telephone. Further, the luminance may be changed stepwise or continuously. Further, the luminance 2 of the backside display part 109 and the luminance 4 of the display part 108 may be arbitrarily set by the user within a prescribed range so as to meet the flash light. Further, as the display part 108 and the backside display part 109, for instance, a liquid crystal display device having a back light, a plasma display, an organic EL, an FED (field emission display), a light emitting diode array, etc. may be employed.

(Second Embodiment)

Now, referring to the drawings, an embodiment of the present invention will be described below.

In this embodiment, a structural example of an electronic apparatus is described by way of an example applied to a portable telephone. Fig. 7 is a block diagram showing the structure of a portable telephone according to one embodiment of the present invention. Fig. 8 is a perspective view showing the structure of an external appearance of the portable telephone according to this embodiment. Fig. 8(a) shows a front surface side and Fig. 8(b) shows a back surface side.

In Fig. 7, the portable telephone of this embodiment includes an antenna 201, a radio transmitting and receiving part 202 as a communication unit for transmitting and receiving a radio signal, a handset 203 having a microphone and a speaker, a voice transmitting and receiving part 204, an operating part 205 having a plurality of key buttons for operating the portable telephone, a storing part 206 composed of a storing element such as a semiconductor memory and an LED part 207 used for informing a user of receiving a call or the state of the portable telephone such as a charging state. Further, the portable telephone includes a first display part 208 and a second display part 209 composed of a liquid crystal display element (LCD), a first image pick-up part 210 and a second image pick-up part 211 as image pick-up units composed of CCD (Charge Coupled Device) image pick-up elements or CMOS (Complementary Metal Oxide Semiconductor) image pick-up elements, a light source part 212 for the first display part, a light source part 213 for the second display part and a control part 214 for controlling respective parts

forming the portable telephone.

The voice transmitting and receiving part 204 outputs the voice of a mate to speak to the speaker of the handset 203 and transmits the voice of the user of this portable telephone inputted to the microphone of the handset 203 to the control part 214. The first display part 208 and the second display part 209 are used for displaying the contents of an operation when various kinds of functions of the portable telephone are performed.

Here, the first display part 208 and the first image pick-up part 210 are provided in the front surface side of the portable telephone as shown in Fig. 8(a). Further, the second display part 209 and the second image pick-up part 211 are provided in the back surface side of the portable telephone as shown in Fig. 8(b). The LED part 207 is disposed in the upper end part of a portable telephone main body so as to see emitted light from both the front surface side and the back surface side.

The LED part 207 corresponds to a light emitting unit described in claims and is formed with LEDs (light emitting diode) of three colors, for instance, red, green and blue. The LED part uses the LEDs having the different colors to realize various kinds of colors as well as white and changes lighting patterns or luminance to realize a variety of informing patterns by a single LED part 207 disposed at one part. For instance, as described above, the LED part 207 informs the user of receiving a call or the state of the portable telephone main body. Further, the LED part 207 also has an informing function of an activating state showing that a power is turned on or a communication function for exchanging data with other portable telephone by using light such as infrared rays. Still further, the LED part 207 has a flash

function for emitting white light with high luminance for imaging and illuminating an image when a shutter button as a lighting instructing unit in the operating part 205 is operated.

The control part 214 corresponds to a lighting control unit described in claims controls light emitting states such as the lighting pattern or the luminance of the LED part 207. The LED part 207 may be used commonly to the light source 213 for the second display part of the second display part 209 to increase or make use of a variation in display for the second display part 209 such as a monochromatic display element having few display colors.

The light source part 212 for the first display part is composed of an LED or the like to form a back light or a front light used to easily see the first display part 208 under a dark environment. Similarly, the light source 213 for the second display part is composed of an LED or the like to form a back light or a front light used to easily see the second display part 209 under a dark environment.

Next, an operation of the portable telephone of this embodiment constructed as described above will be described below.

When the user performs an operation for turning on the power by the operating part 205, the operation is detected by the control part 214 to make respective parts of the portable telephone operable. After the portable telephone is made to be usable, when the user performs an operation for dialing the telephone number of a mate of a called side by the operating part 205 or an operation for calling the telephone number of the mate of the called side stored in the storing part 206 to operate a transmitting key button, the control part 214 performs a calling operation to transmit a radio signal for calling from the

antenna 1 through the radio transmitting and receiving part 202.

The radio signal transmitted from the antenna 201 is received by a base station that is not shown in the drawing. When the base station receives the radio signal, the base station calls the mate whom the user of a calling side is desired to speak to. When the mate responds to the call, a radio signal for the response is received by the radio transmitting and receiving part 202 through the antenna 201. Thus, the voice transmitting and receiving part 204 can be operated under the control of the control part 214 so that the user can speak to the mate by using the handset 203.

When the power is turned on, the first display part 208 and the second display part 209 display a state showing that the power is turned on under the control of the display of the control part 214. Further, when the telephone number is inputted or the telephone number stored in the storing part 206 is called, the telephone numbers are respectively displayed on the first display part 208 or the second display part 209 under the control of the control part 214. When the mate responds to the call, the mate responding the call is displayed on the first display part 208 or the second display part 209.

The LED part 207 is lighted for informing the user of receiving a call together with a call receiving sound in accordance with the control of the control part 214. Further, the LED part 207 shows the states of the portable telephone such as during speaking, during charging or the completion of charging by light emitting states or informs the user of turning on a power even when the first display part 208 or the second display part shows a state that the power is turned off.

Further, when an object to be imaged is imaged, the control part 214

controls the first image pick-up part 210 and the second image pick-up part 211 to capture the imaged image. At this time, when the shutter button is operated under the imaging instructing operation of the operating part 205, the control part 214 transfers and stores image data obtained by picking up an image by the first image pick-up part 210 or the second image pick-up part 211 to the storing part 206 as image picked up data.

Here, an imaging operation when the image is picked up by using the second image pick-up part 211 and the state of luminance of the LED part 207 in the imaging operation will be described below. Fig. 9 is a flow chart showing a schematic procedure of the imaging operation when the second image pick-up unit 211 is used. Figs. 10 is an explanatory view of an operation showing the states of luminance of the LED part 207 during a preview operation and during an image pick-up operation.

In this embodiment, when the second image pick-up part 211 is used to image the image, the first display part 208 or the second display part 209 is employed instead of a finder to display the imaged image of the object to be imaged. The LED part 207 is employed as a flash light source. When an imaging operation is started, the red LED of the LED part 207 is lighted as shown in Fig. 10 to show the operating state of the second image pick-up part 211 and show that the image pick-up part operates under the state of a luminance "2" (step S31). Then, the preview operation is performed in which the image data obtained by the second image pick-up part 211 is continuously displayed on the first display part 208 or the second display part 209 (step 32).

Here, instead of obtaining the state of the luminance "2", the LED part may be turned off with a luminance "0" the same as that during stopping (during

non-operation). However, when the image is imaged under a dark environment as in a room, a red eye phenomenon in which light is reflected in the eyes so that the eyes are imaged in red since the pupils of a human being are dilated is arise. In this embodiment, since the LED part is used instead of a light for lighting the object to be imaged, the LED part 207 is lighted with the luminance of "2" having brightness to some degree to serve as a previous light emission during the light emission of a flash.

Then, it is determined that whether or not the shutter button of the operating part 205 is pressed (step S33). When the shutter button is not pressed, the preview operation of the step S32 is repeated. When the shutter button is pressed, the control part 214 lights respectively the LEDs of green and blue of the LED part 207 at the same time to set a luminance to a luminance "3" brighter then the luminance "2" to emit the light of a flash (step S34). Then, the image data obtained by the second image pick-up part 211 at the timing of emitting the light of the flash is stored in the storing part 206 as the image picked up data (step S35). When the image picked up data is captured, the LEDs of green and blue of the LED part 207 are respectively turned off to return the luminance "3" to the luminance "2" to finish the light emission of the flash (step S36).

Fig. 11 is an explanatory view of an operation showing the change of the luminance of the LED part 207. In Fig. 11, assuming that rectangular forms respectively arranged in the sides of red, green and blue show one unit time, a part described as "ON" represents that the LED is turned on for one unit time.

When a call is not received in a telephone communication and a

display is stopped, that is, in an example shown in Fig. 11(a), the LED 207 has a luminance "0". Under this state, when a call is received, as shown in Fig. 11(b), a pattern of simultaneously turning on/simultaneously turning off the LEDs of green and blue is repeated at intervals of prescribed periods (here, six unit times constitute one period) (a light emission for a first use of lighting). Then, when the preview operation is carried out, as shown in Fig. 11(c), only the LED of red is constantly turned on. Under this state, when the shutter button is pressed to image the image, as shown in Fig. 11(d), the LEDs of green and blue are respectively turned on for one unit time to emit the light of the flash (a light emission for a second use of lighting).

As described above, according to the portable telephone of this embodiment, the flash function can be realized without requiring to newly add a flash device or a light emitting diode. Thus, problems such as the increase of a mounting area or thickness due to the addition of new members, the increase of a cost and the increase of noise can be solved. Further, since the luminance can be enhanced only for a moment when the image is picked up, a consumed electric power can be reduced.

In the above-described embodiment, the change of the luminance of the LED part 207 is realized by turning on or lighting the LEDs of the different colors. However, the change of the luminance may be realized by using a plurality of LEDs of the same color or increasing electric current supplied to the LEDs.

In the above-described embodiment, the first use of lighting of the LED part 207 is to inform the user of receiving a call of a telephone and the second use of lighting is to emit the light of the flash. However, as the first use of

lighting or a new third use of lighting, the LED may be used for informing the user of a time of alarm when it is a prescribed alarm setting time or informing the user of receiving an electronic mail.

Further, in the above-described embodiment, the example of the operation in the case that the image is picked up by the second image pick-up part 211 is described. However, the above-described example may be similarly realized by the first image pick-up part 210.

Further, in the above-described embodiment, the structural example is shown in which the two image pick-up parts (the first image pick-up part 210 and the second image pick-up part 211) and the two display parts (the first display part 208 and the second display part 209) are mounted on the portable telephone. However, the flow of the image pick-up operation and the display contents and the luminance of the display parts during the image pick-up operation may be considered to be the same irrespective of the number of the image pick-up parts and the display parts. Accordingly, one embodiment of the present invention may be realized without any change.

Still further, in the above-described embodiment, the flash function is realized by emitting the light of the LED part 207. However, the flash function may be realized by the light source part 212 for the first display part or the light source part 213 for the second display part. That is, when the image is imaged by the first image pick-up part 210 in the front side, the luminance of the light source part 212 for the first display part may be raised to emit the light of the flash. When the image is imaged by the second image pick-up part 211 in the back surface side, the luminance of the light source part 213 for the second display part may be raised to emit the light of the flash.

Still further, the above-described embodiment shows an example to which the control of the luminance of the LED is applied to the portable telephone. It is to be understood that the control of the luminance of the LED may be applied to not only an electronic apparatus such as a PDA (a portable information terminal) with a camera, but also to a personal computer (what is called a note type personal computer).

Now, applied examples of the portable telephone according to this embodiment will be described below.

Fig. 12 is a perspective view showing the structure of an external appearance of a first applied example of the portable telephone according to this embodiment. In the first applied example, an LED part 12 is disposed so as to slide forward and backward (in a vertical direction relative to the image pick-up surface of an image pick-up part) relative to a portable telephone main body. With such a structure, an intensity of illumination upon emitting the light of a flash can be improved.

Fig. 13 is a perspective view showing the structure of an external appearance of a second applied example of the portable telephone according to this embodiment. In the second applied example, an LED part 12 is disposed so as to slide upward and downward (in a parallel direction relative to the image pick-up surface of an image pick-up part) relative to a portable telephone main body. With such a structure, an intensity of illumination upon emitting the light of a flash can be improved like the first applied example.

Fig. 14 is a perspective view showing the structure of an external appearance of a third applied example of the portable telephone according to this embodiment. In the third applied example, reflecting materials 215 are

provided in the periphery of an LED part 12. The reflecting materials 215 are angled and arranged so that light expands forward (in a forward direction relative to the image pick-up surface of an image pick-up part) relative to a portable telephone main body. The same reflecting materials are provided in the back surface side of the portable main body. With such a structure, an intensity of illumination upon emitting the light of a flash can be improved like the first and second applied examples.

Positions at which the LED parts 12 are disposed are not limited to positions shown in Fig. 8 and Figs. 12 to 14 and may be provided at any arbitrary positions depending on the structures of the portable telephones. The LED parts may be suitably provided at, for instance, a front surface part of the portable telephone main body, a back surface part, both the front surface part and the back surface part, a side surface part, a part near the corner part of a casing member, a hinge part or a part near the hinge part, an end part of an operating part, etc.

According to the above-described embodiments, one light emitting unit composed of the LED is lighted respectively for uses with different luminance, so that the LED can be employed for a plurality of uses. For instance, when the first use of lighting is to inform the user of receiving a call, the second luminance for the second use of lighting is higher than the first luminance for the first use of lighting. Thus, the light emitting unit composed of the LED can be used as the flash when the image is imaged by the camera. Accordingly, an exclusive light emitting unit for improving the quality of the image under the environment of a low intensity of illumination does not need to be provided. A problem that the mounting area or the thickness is increased due to the addition

of the new members can be solved. Problems that a cost for a material is required to increase the cost and noise is increased due to the increase of the light emitting units can be solved. Therefore, in the above-described embodiments, in the electronic apparatus having the image pick-up unit, while the flash function is mounted to improve the quality of the image under the environment of the low intensity of illumination, a miniaturization, a low cost and low noise can be realized.

Further, the first use of lighting of the light emitting unit is to inform the user of receiving a telephone call. Accordingly, the user can visually recognize the received call of the telephone or the like. Further, the first use of lighting of the light emitting unit is to inform the user of a time of alarm. Accordingly, the user can visually recognize the time of alarm of the setting time. Further, the second use of lighting of the light emitting unit is to image and light the image. Accordingly, the one light emitting unit can be used not only for informing the user of receiving a call or the time of alarm, but also for imaging and lighting the image.

The present invention is described in detail by referring to the specific embodiments. However, it is to be understood to a person with ordinary skill in the art that various changes and modifications may be made without departing from the spirit and the scope of the present invention.

This application is based on Japanese Patent Application No. 2002-360843 filed on December 12, 2002 and Japanese Patent Application No. 2002-377208 filed on December 26, 2002 and the contents thereof are incorporates herein as references.

<Industrial Applicability>

As described above, in the electronic apparatus and the imaging method using the electronic apparatus, the electronic apparatus capable of realizing a flash function can be provided without mounting new parts. As a result, the increase of the mounting area or the thickness, the generation of noise upon emitting the light of a flash and the increase of a cost can be eliminated.